REVISION OF THE SPECIES OF *EUCRASSATELLA* AND *SPISSATELLA* IN THE TERTIARY OF VICTORIA AND TASMANIA

By Thomas A. Darragh
Geology Department, University of Melbourne

Abstract

Eucrassatella and *Spissatella* are crassatellid molluscs with resilifers extending from the beak to the ventral edge of the hinge plate and generally with smooth internal ventral margins. Five new species of *Eucrassatella* are described and other species redescribed. *Spissatella* is recorded from Australia for the first time. New species described are *Eucrassatella eupontica, E. dorsennata, E. rosicollina, E. deltoides* and *E. memanae.*

Introduction

The larger Tertiary crassatellid genera are *Crassatella* Lamarck (= '*Crassatellites*' auct.), *Bathytormus* Stewart, *Eucrassatella* Iredale, *Hybolophus* Stewart and *Spissatella* Finlay. *Crassatella* has a crenulated internal ventral margin and a resilifer extending from the beak halfway to the ventral border of the hinge plate (Stewart 1930, p. 136). *Spissatella* and *Eucrassatella* possess a resilifer extending from the beak to the ventral edge of the hinge plate. *Bathytormus* from the Palaeogene of North America and Europe and *Hybolophus* from the Neogene of North and Central America also have this feature; however, the former has a crenulated internal ventral margin which is absent in *Eucrassatella, Hybolophus,* and all species of *Spissatella* except early Tertiary species such as *Spissatella australis* (Hutton). *Bathytormus* also differs from *Eucrassatella* and *Spissatella* by having greater development of tooth 4b. *Spissatella* is generally smaller than *Eucrassatella,* has a more angular outline, and a prominent tooth 3a. *Hybolophus* has opisthogyral or orthogyral umbones, a sinuous ventral margin, and rather elongate anterior laterals.

Prior to the present work only two genera of the larger crassatellids have been recognized in the Australian Tertiary, *Eucrassatella* and *Crassatella.* The former was represented by 4 species—*Eucrassatella oblonga* (Tenison Woods), *E. maudensis* (Pritchard), *E. kingicoloides* (Pritchard), and *E. camura* (Pritchard); the latter by *Crassatella dennanti* Tate, a species similar to the typical crassatellids of the Palaeogene of Europe. *Crassatella dennanti* is not dealt with in this revision. This revision shows that *Crassatellites maudensis* Pritchard from Torquay is congeneric with certain New Zealand species belonging to the genus *Spissatella.*

Table 1 summarizes the stratigraphical and geographical distributions of the various species.

Geographical Distribution

Recent Species: The only living larger crassatellids are *Crassatella* s.l. *Eucrassatella* and *Hybolophus. Eucrassatella* is confined to Australian waters, having a distribution from Torres Strait down the E. coast, to the N. coast of Tasmania, across southern Australia, and up the W. coast. Species from the Central American region (California to Peru and the West Indies) do not belong in *Eucrassatella* but in *Hybolophus.* No living species have been recorded from New Zealand or Japan.

TABLE 1

Eucrassatella		
oblonga	Janjukian (Upper Oligocene)	Fossil Bluff near Wynyard, Tasmania
eupontica	(Balcombian?) Bairnsdalian (Middle (?) Miocene)— Cheltenhamian (Upper Miocene)	Port Phillip, Gippsland
rosicollina	Upper Mitchellian (Upper Miocene)	Gippsland
dorsennata	Cheltenhamian—Lower Kalimnan (Lower Pliocene)	Gippsland, W. District; ? Adelaide
camura	Cheltenhamian—Kalimnan	W. District
kingicoloides	Upper Cheltenhamian—Kalimnan	Gippsland
deltoides	Middle (?) Pliocene	Flinders Is.
memanae	Upper (?) Pliocene	Flinders Is.
Spissatella		
maudensis	Janjukian	Port Phillip, (?) Gippsland
Crassatella		
dennanti	Batesfordian (Lower Miocene) —Bairnsdalian	Gippsland, Port Phillip, W. Victoria

FOSSIL SPECIES: *Eucrassatella* is widespread in the Tertiary of southern Australia occurring in Gippsland, C. and W. Victoria, the Murray Basin, and the Adelaide Basin in South Australia, Flinders Is., and the N. coast of Tasmania. In the Tertiary of New Zealand there are at least two species (*E. ampla* (Zittel) and *E. attenuata* (Hutton)). The author has examined an undescribed species from the Miocene of the Mai Mai Dome, New Guinea, and the genus has been recorded from the Tertiary of Japan. Mizuno (1952) records three species from the Oligocene, two of which he doubtfully places in the genus; judging from the original figures and description (Nagao 1928) the third species, *Crassatellites yabei* Nagao, is a true *Eucrassatella.* Shuto's record (1952) of the genus from the Upper Miocene of Japan is based on a fragmentary specimen whose generic placement cannot be determined from the illustration. Records of the genus from North and South America are based on species which appear to belong in *Hybolophus.*

The genus *Spissatella,* hitherto only recorded from the Tertiary of New Zealand, also occurs at Torquay, possibly at Maude near Geelong, and in Gippsland, all in Victoria.

Habitat

DEPTH: Verco (1905, p. 169) dredged specimens of *Eucrassatella donacina* (Lamarck) from South Australia in 15-20 fathoms and later (1907) dredged specimens in 40 and 100 fathoms 'both small and poor'. Iredale (1924, p. 202) recorded *Eucrassatella kingicola* (Lamarck) taken by Roy Bell in Twofold Bay from depths ranging from 15 to 25 fathoms. Macpherson & Gabriel (1962, p. 315) record the same species from 8 fathoms in Western Port and the author examined dredged specimens in Western Port from 6 to 8 fathoms. The available information seems to suggest that the southern members of the genus, at least, are common in the offshore neritic zone. Fossil members of the genus presumably lived in similar depths.

NATURE OF BOTTOM SEDIMENT: Little information is available on the nature of the bottom sediment on which the recent species live. Iredale (1924, p. 202) recorded specimens dredged from coarse sand to soft mud in Twofold Bay, N.S.W., and the author has examined dredged specimens from coarse shell sand in Western Port Bay, Vict. Fossil species are found in sediments ranging from coarse sand (basal Freestone Cove Sandstone at Fossil Bluff) to fine silts (Newport Formation at Altona). However, specimens from very fine sediments are rare, as in the Newport Formation and the Bullenmerri 'Clay'. The fossils are common only in those fine sediments with a high proportion of coarse broken shell material such as the Jemmy's Point Formation. Frequently beds are composed almost entirely of *Eucrassatella* and broken shells, as in the lower shell band at Jemmy's Point.

Stratigraphical Distribution

The proved time range of *Eucrassatella* in Australia is from Janjukian (Upper Oligocene) to the present. Possibly the earliest Australian fossil *Eucrassatella* is a complete left valve from the Upper Eocene of Point Flinders (AW1) near Cape Otway collected by Wilkinson in 1864, but, despite a search of all available collections and an examination of the locality itself, no further examples have been found. Unfortunately no matrix is preserved on the specimen so that the locality cannot be verified. The specimen superficially resembles *Eucrassatella eupontica* sp. nov.

The oldest undoubted species is *Eucrassatella oblonga* from the Janjukian (Upper Oligocene) of Fossil Bluff near Wynyard, Tasmania. The *Eucrassatella* species from Japan are recorded from somewhere in the Oligocene. Finlay and Marwick (1940) give the time range for *Eucrassatella* in New Zealand as Hutchinsonian (Lower Miocene) to Waitotarian (Lower Pliocene).

Marwick (1960) gives the range of *Spissatella* in New Zealand as Matau series (Paleocene) to Taranaki series (Upper Miocene). In Victoria the genus is restricted to the Janjukian.

Hinge Terminology

The notation used to describe the teeth is that of Munier-Chalmas and is based on Lamy (1917) who considered the crassatellid tooth pattern to be lucinoid. There has been confusion in the placing of the Astartacea within the heterodonts, some authors placing the superfamily with the lucinoids, others with the cyrenoids. Davies (1935) considered that the hinge was lucinoid but had been modified to give a cyrenoid appearance by the addition of an extra tooth 5b in the right valve. He split off the Astartacea and Carditacea from the lucinoids and cyrenoids because of this peculiarity. Korobkov (1954) retains Davies's three divisions giving them the formal names Lucinodonta, Astartedonta and Cyrenodonta. He has retained the lucinoid formula in his notation of the hinge of the Astartedonta.

Measurements

Measurements on the valves have been made either parallel to a line joining the muscle scars or perpendicular to this line. The following symbols are used: L-Length of valve, A-maximum distance of the beak from the anterior margin, H-maximum height of valve, T-maximum thickness of valve, U-distance of the umbo to the ventral margin directly beneath the beak. $\frac{L}{U}$ and $\frac{A}{L}$ are ratios of these measurements. All measurements are in millimetres.

Siphonal Ridge

No suitable term appears to exist for the external ridge which runs from the umbo to the posterior ventral corner of each valve. The ridge is the anterior edge of the siphonal area. The term siphonal ridge is used in the descriptions for this feature.

Material

The bulk of the specimens used in this study are housed in the National Museum of Victoria. The Cudmore, Pritchard, and Colliver collections have provided large suites of topotypic material. These collections have been supplemented by material collected by the author and that borrowed from Dr O. P. Singleton, Mr J. Hollis, the University of Adelaide, the Mines Department of South Australia, the Commonwealth Palaeontological Collection, the Tasmanian Museum, and the Melbourne University Geology Department. Registered numbers quoted throughout are prefixed by a symbol identifying the institution to which they belong, thus—

National Museum of Victoria—P
Melbourne University Geology Department—MUGD
Commonwealth Palaeontological Collection—F or CPC
Tasmanian Museum—B and Z.

Systematic Descriptions

Suborder ASTARTEDONTA Korobkov 1954

Hinge lucinoid but with greater development of tooth 3b and introduction of 5b.

Formula $$\frac{\mathrm{AI}\quad \mathrm{AIII}\quad 3a\quad 3b\quad 5b\quad \mathrm{PI}\quad \mathrm{PIII}}{\mathrm{AII}\quad \mathrm{AIV}\quad 2\quad 4b\qquad \mathrm{PII}\quad \mathrm{PIV}}$$

Superfamily ASTARTACEA

Family CRASSATELLIDAE Gray

Genus **Eucrassatella** Iredale 1924

Eucrassatella Iredale 1924, *Proc. Linn. Soc. N.S.W.* 49 (3): 202.

Type species (original designation): *Crassatella kingicola* Lamarck 1805.

Shell thick, heavy, equivalve, ovate to sub-oblong, occasionally subquadrate. Umbo prosogyral. Siphonal ridge present. Lunule and escutcheon deeply impressed. Ornament consisting of concentric ribs usually confined to the umbonal region, occasionally entirely absent or extending to the ventral border of the valve.

Hinge plate short and with a large triangular resilifer extending from under the beak to the ventral edge of the hinge plate. Ligament pit narrow, posterior to the resilifer. Tooth formula $\frac{3a\quad 3b\quad 5b\quad \mathrm{LPI}}{\mathrm{LAII}\ 2\quad 4b}$. Laterals are variable and are poorly developed in most cases being an extension of the valve margin. 3b is strongly developed and has its sides grooved, 3a and 5b usually not well developed, 5b has no corresponding socket in the left valve.

Pallial line simple and impressed. Pedal impression deep beneath the hinge plate and just behind the anterior muscle scar. Muscle scars large sub-equal deeply impressed, the anterior scar a little elongated dorso-ventrally, the posterior scar sub-circular.

Interior of shell porcellaneous. Ventral margin of the valves smooth without crenulations.

Eucrassatella kingicola (Lamarck 1805)

(Pl. 15, Fig. 38-40)

Crassatella kingicola Lamarck 1805, *Ann. Mus. Hist. Nat. Paris* 6: 409. Lamarck 1818, *Histoire naturelle des animaux sans vertèbres* 5: 481. Lamy 1917, *Jour. de Conchyl.* 62 (4): 205, Pl. 6, fig. 1 (q.v. for complete synonomy).

TYPE LOCALITY: King Is., Bass Strait. Collected by Peron and Leseuer.

LOCATION OF TYPE: Museum d'Histoire Naturelle de Paris.

STRATIGRAPHICAL RANGE: (?) Werrikooian (U. Plio.-L. Pleist.) to Recent.

GEOGRAPHICAL DISTRIBUTION: Southern N.S.W., Bass Strait, N. coast of Tasmania.

DISCUSSION: The species is represented in the Werrikooian by one valve collected by G. B. Pritchard (P23064) from Limestone Ck, Glenelg R. The holotype is not typical of the species, being rather ovate; generally the species is more rostrate i.e., the posterior is produced into a flare. Two specimens, one from Tasmania, the other from Twofold Bay, N.S.W. in the collection of the Australian Museum (Reg. No. C42191 & C49906 respectively), compare well in shape with the holotype. Lamy (1913, p.101 footnote) has discussed the authenticity of Lamarck's type specimens and concludes that the specimen illustrated is authentic. The locality written on the shell is apparently in the handwriting of Lamarck.

The name *Crassatella kingicola* is first given without description on p. 408 of Lamarck 1805. However, on p. 409, when describing the fossil *Crassatella tumida* from Grignon, he validates the name *Crassatella kingicola* by giving a brief description when comparing the living species with the fossil.

Eucrassatella oblonga (Tenison Woods 1876)

(Pl. 12, fig. 4, 9-10; Pl. 14, fig. 21)

Crassatella oblonga Tenison Woods 1876, *Proc. Roy. Soc. Tas.* for 1875: 25, fig. 11. Johnston 1888, *Geol. Tas.* Pl. 29, fig. 1, la. Pritchard 1896, *Proc. Roy. Soc. Vict.* 8: 131.
Crassatella aphrodina Tension Woods 1876, *Proc. Roy. Soc. Tas.* for 1875; 24, fig. 12. Johnston 1888, *Geol. Tas.* Pl. 29, fig. 2. Pritchard 1896, *Proc. Roy. Soc. Vict.* 8: 131.

DESCRIPTION OF HOLOTYPE: B42 Z174, left valve.

Shell large, very elongate, somewhat rectangular; umbo prosogyral situated about $^{10}/_{27}$ of the length of the valve from the anterior end. Anterior dorsal margin straight, posterior dorsal margin straight then curving out above the posterior muscle scar, truncated by the short, straight posterior margin. Anterior margin short and very convex, hardly differentiated from the dorsal and ventral margins. Ventral margin gently convex. Siphonal ridge present but not prominent, siphonal area very narrow and somewhat concave. Hinge plate thick, wide, rather short about $^{2}/_{7}$ of the vertical diameter of the valve.

Teeth. LAII short but prominent, socket for 3a very narrow considerably encroached upon by the lunule, 2 prominent sloping slightly to the anterior, 4b thin somewhat higher and pointed at its ventral end, virtually obsolete. Posterior laterals obsolete. Ligament pit narrow rather deeply impressed, separated from the large resilifer by a slight rise.

Ventral margin of shell smooth.

Exterior of valve ornamented with fine growth striae.

Description of Hypotype: P23073, right valve.

Shell relatively shorter than the holotype. Posterior end only sightly flared.

Teeth. Anterior lateral absent. 3a short, not very prominent, grooved on inner side, somewhat encroached upon by the lunule, 3b grooved somewhat triangular very prominent, sloping posteriorly, socket for 2 wide and deep. 5b thin virtually obsolete, socket for 4b small and circular, LAI long and prominent.

Valve ornamented with fine growth striae, umbo with 19 thin ribs extending 11 mm from the beak, inter-rib spaces as wide as the ribs.

Dimensions:

Holotype	B42 Z174	L95	A26	H66	T19	U63	$\frac{L}{U}$1·50	$\frac{L}{A}$3·6	
Hypotype	P23073	76	18	57	15	53	1·44	4·2	Lower Bed
Type of *aphrodina*	B27 Z199	54	17	44	—	42	1·29	3·2	
	P22462	60	19	52	15	51	1·18	3·2	Upper Bed
	P22469	98	33	73	23	71	1·38	3·0	Upper Bed
	P22434	73	24	55	15	54	1·35	3·1	Lower Bed
					(Worn)				

Location of Type: Holotype B42 Z174, Tas. Mus., Hobart. Type of *aphrodina* B27 Z199 Tas. Mus., Hobart. Hypotype P23073 Nat. Mus. Vict., collected by F. S. Colliver.

Type Locality: 'Table Cape' i.e., Fossil Bluff near Wynyard, Tas. Matrix indicates that the holotype came from the Freestone Cove Sandstone of the Table Cape Group i.e., the lower or *Crassatella* Bed. Matrix indicates that the type specimen of *Crassatella aphrodina* comes from the Fossil Bluff Sandstone of the Table Cape Group i.e., the upper or *Turritella* Bed. Age Janjukian.

Stratigraphical Distribution: Janjukian (Upper Oligocene or Lower Miocene).

Occurrence: Fossil Bluff near Wynyard, Tasmania.

Material: Type specimens. 40 specimens from the Freestone Cove Sandstone. 12 specimens from the Fossil Bluff Sandstone.

Comments: The exterior of the holotype has the umbonal ribs and growth striae worn away, a common feature of specimens from the lower bed at Fossil Bluff. The posterior end of the valve is broken, about 1-2 mm of the valve is missing, this is shown in Tenison Woods's original figure. The exterior of the valve has two labels attached, the upper with 'Type' written thereon, the lower '*Crassatella oblonga*' in faded ink.

The writer agrees with Pritchard (1896, p. 131), Dennant and Kitson (1903, p. 124), and May (1919, p. 105) that *Crassatella aphrodina* is synonymous with *Crassatella oblonga*. Tenison Woods has chosen an extremely elongate specimen of *oblonga* for a type. Generally, specimens are not as elongated and the posterior flare is not as pronounced. The figured hypotype illustrates the typical shape of the species. In some specimens, particularly those from the upper bed, the anterior dorsal margin is slightly concave giving the umbo a more pointed and prominent appearance. Of the large number of specimens available to the writer from the Lower bed at Fossil Bluff, none can be matched exactly with the type specimen, though some specimens approach it in size and shape; the $\frac{L}{U}$ ratio 1·50 is the largest recorded from a group of 50 specimens.

The type of *Crassatella aphrodina* is an immature specimen comprising a pair of cracked valves. Part of the left valve is missing. It is considerably less elongate than the type of *C. oblonga,* having a $\frac{L}{U}$ ratio of 1·29, a few specimens from the upper bed at Fossil Bluff are even less elongate having a $\frac{L}{U}$ ratio of 1·15. The series of specimens available shows a gradation from *C. aphrodina* through to *C. oblonga.*

Although the name *C. aphrodina* has page priority, *C. oblonga* is better known and has been used as the name for the Table Cape shell for many years, and as *C. aphrodina* has been founded on a damaged, immature specimen it would seem preferable to retain the name *C. oblonga* for the *Eucrassatella* from Fossil Bluff.

Eucrassatella eupontica sp. nov.

(Pl. 13, fig. 13-14, 16; Pl. 15, fig. 32)

ETYMOLOGY: Greek eu = fair, pontos = sea, translation of place name Beaumaris.

DESCRIPTION OF HOLOTYPE: P23074, right valve.

Valve subtrigonal slightly elongate. Umbo small, not prominent prosogyral situated ⅓ of the valve length from the anterior end. Anterior and posterior dorsal margins straight, the anterior sloping away from the umbo at a steeper angle. Anterior margin gently convex passing into a convex ventral margin. Posterior margin straight obliquely truncating the dorsal and ventral margins. Posterior end of the valve scarcely attenuated.

Siphonal ridge straight, not prominent, tending to fade towards the ventral margin.

Teeth. 3a very thin, 3b thick, prominent, sloping anteriorly, 5b relatively thick. LPI very long. Socket for 2 as wide as 3b.

Resilifer rather narrow, ligament pit well differentiated from the resilifer.

Ventral margin of valve smooth.

Umbo ornamented with 22 concentric ribs fading out 1·0 cm from the beak. Surface of valve ornamented with fine growth striae.

DESCRIPTION OF PARATYPE: P23075-6, pair.

Shell more elongate than the holotype and rather tumid. Posterior dorsal margin concave. Siphonal ridge prominent.

Teeth. LAII very short, 2 short and thick, 4b not prominent.

Umbo ornamented with 18 ribs fading out 0·7 cm from the beak. The remains of the resilium were found in the resilifer when the valves were separated.

DIMENSIONS:

Holotype	P23074	L69	A23	H56	T14	U54	$\frac{L}{U}$1·28	$\frac{L}{A}$3·0	Beaumaris
Paratype	P23075	60	21	49	17	48	1·25	2·9	Warrambine Ck
	P23077	79	30	67	19	66	1·20	2·6	Beaumaris

LOCATION OF TYPES: Nat. Mus. Vict., holotype P23074, Cudmore collection. Paratype P23075-6, collected by T. A. Darragh.

TYPE LOCALITY: Shell bed immediately above the nodule bed, Beaumaris, Vict. Black Rock Member of the Sandringham Sands Formation. Age Cheltenhamian (U. Mioc.)

STRATIGRAPHIC RANGE: Balcombian(?) Bairnsdalian-Cheltenhamian.

OCCURRENCE:	Altona Bay Coal Shaft No. 2, 2 specimens. (?) MacRae's Quarry upstream from Princes H'way Toorloo Arm, Gippsland. Present as moulds in limestone.
Bairnsdalian	Warrambine Ck near Inverleigh, Grid Ref. 090982, Geelong, common.
Mitchellian	Moondara Farm, F72 GSV, Bairnsdale, Grid Ref. 512341, 1 specimen. Lakes Entrance Oil Shaft. Exact horizon unknown but between 10-150 ft. The matrix suggests that some of the fossils came from the 'greenish-grey sandy marls with glauconite' at 50-150 ft. The age of the sediments at this depth is probably Cheltenhamian. Bore, Parish of Yeerung, Gippsland, 380 ft, 1 specimen. Bore No. 3, Parish of Moormurng, 260 ft, 1 specimen.
Cheltenhamian	Beaumaris above the nodule bed, common.

MATERIAL: Type and 26 specimens Beaumaris, 11 specimens Warrambine Ck.

COMMENT: This species differs from *E. kingicoloides* in having a prominent prosogyral umbo and lacking the marked posterior attenuation of the shell. The fossil species closest to *E. eupontica* is *E. oblonga* which is generally more elongate, has more produced umbos, and a greater attenuation of the posterior end.

Eucrassatella rosicollina sp. nov.

(Pl. 12, fig. 5-7)

ETYMOLOGY: Rose Hill, the old name for the type locality.

DESCRIPTION OF HOLOTYPE: P23078, right valve.

Valve roundly pentagonal, somewhat flattened. Umbo depressed, prosogyral situated ⅔ of the valve length from the anterior end. Anterior dorsal margin slightly convave, posterior dorsal margin slightly convex. Anterior margin strongly convex, ventral margin slightly convex, posterior margin very slightly convex symmetrically truncating the ventral and posterior dorsal margins. Posterior end of valve very little attenuated.

Siphonal ridge weakly developed but not fading as it approaches the ventral margin.

Hinge plate ⅙ umbo ventral diameter.

Teeth. 3a rather strongly developed, 3b prominent, lateral grooving reduced, 5b obsolete. LPI prominent, narrow and wedge shaped. Socket for 2 rather wide. Resilifer rather narrow, external ligament pit very wide.

Umbo ornamented with 9 ribs, these fade out 3 mm from the beak. Ribs are absent on the initial 0·5 mm and on the area posterior to the siphonal ridge. Surface of valve ornamented with fine growth striae.

DESCRIPTION OF PARATYPE: P23079, left valve.

The valve is similar in shape to the holotype.

Teeth. LAII thin prominent, 2 thin not prominent, 4b thin obsolete, the teeth have no lateral grooves. LPII short and prominent. Socket for LPI curved and wedge shaped fading into the hinge plate as it approaches the external ligament area.

Umbo ornamented with 8 ribs which fade out 3 mm from the beak.

DIMENSIONS:

Holotype	P23078	L64	A25	H50	T14	U50	$\frac{L}{U}$ 1·28	$\frac{L}{A}$ 2·5
Paratype	P23079	65	28	52	15	52	1·25	2·3
Paratype	F17001	65	27	52	13	52	1·25	2·4
	P23040	65	27	50	15	50	1·18	2·4
	P23041	64	25	53	14	53	1·20	2·6

LOCATION OF TYPES: Nat. Mus. Vict., holotype P23078, collected by T. A. Darragh. Paratype P23079. Tate Museum, University of Adelaide, paratype F17001.

TYPE LOCALITY: Moondara Farm (part of the old Rose Hill) near E. fence of the bull paddock behind the milking shed, about half way up bank. Grid Ref. Bairnsdale 512341, GSV F72. Tambo River Formation. Age Uppermost Mitchellian.

OCCURRENCE: Type locality.

MATERIAL: Type specimens, 16 topotypes. 1 specimen, 'Rose Hill' CPC F3794.

COMMENTS: The species is recognized by its pentagonal outline, the depressed umbo, reduced umbonal ornament, the smooth cardinal teeth, and the wedged shaped posterior lateral tooth of the right valve. This species does not resemble any Australian *Eucrassatella* but is very similar in the hinge structure and general appearance to the New Zealand *Eucrassatella attenuata* (Hutton).

Eucrassatella dorsennata sp. nov.

(Pl. 13, fig. 18; Pl. 14, fig. 27-29)

?*Eucrassatella camura* (Pritchard) Cotton 1947, *Rec. S. Aust. Mus.* 8 (4): 662, Pl. 20, fig. 15, 16.

?*Eucrassatella kingiculoides* (Pritchard) Crespin 1950, *Proc. Roy. Soc. Vict.* 60: 153, Pl. 14, fig. 6.

ETYMOLOGY: Latin *dorsennus* a hunch back.

DESCRIPTION OF HOLOTYPE: P23042, right valve.

Valve rectangular, very elongate somewhat swollen, umbo depressed prosogyral situated $2/7$ of the valve length from the anterior end. Anterior and posterior dorsal margins straight. Anterior dorsal margin sloping very steeply away from the umbo. Anterior margin convex passing into a gently convex ventral margin. Posterior margin slightly convex, obliquely truncating the posterior dorsal and ventral margins, posterior end of shell slightly attenuated.

Siphonal ridge present but weakly developed. Umbo very little produced, valve humped anteriorly at the base of the umbo.

Teeth. LAI obsolete. 3a very reduced in length but rather pointed. 3b very prominent, pointed and sloping anteriorly, 5b very thin. LPI long and prominent. Socket for 2 wide and deep. Resilifer wide, external ligament deeply impressed. Ventral margin of valve smooth.

Umbo ornamented with 20 ribs; these fade out 1·5 cm from the beak. Surface of valve ornamented with growth striae.

DESCRIPTION OF PARATYPE: P23043, left valve.

Similar in shape to the holotype. Siphonal ridge scarcely visible. The umbo is more depressed than in the type.

Teeth. LAII short, prominent; 2 rather short but pointed, 4b very thin and reduced, pointed at the ventral end.

Umbo ornamented with 22 ribs fading out 1·5 cm from the beak.

Dimensions:

Holotype	P23042	L73	A22	H 53	T18	U51	$\frac{L}{U}$ 1·43	$\frac{L}{A}$ 3·3
Paratype	P23043	66	20	47	15	45	1·46	3·3
	P23044	68	19	47	16	46	1·48	3·6
	P23045	72	23	52	20	52	1·38	3·1

Location of Type: Nat. Mus. Vict., holotype P23042, Cudmore Collection. Paratype P23043, Cudmore Collection.

Type Locality: Jemmy's Point Formation. Mississippi Ck Tramway Cutting F2 on GSV map, Bairnsdale 878332, Gippsland, Victoria.

Age: Cheltenhamian.

Stratigraphical Distribution: Cheltenhamian (U. Mioc.)—Kalimnan (L. Plio.).

Occurrence: Type locality, common.
Ritchie's Rd Cutting, W. side of Mississippi Ck, F1 on GSV map Bairnsdale 878329, common.
North Arm, 1 mile up the Arm, end of Hunter Rd.
No. 1 Bore, Kalimna Oil Co., Rigby Is., Lakes Entrance, 70 ft, CPC F3771.
Lower Shell Bed, Jemmy's Point, Lakes Entrance, uncommon.
Spring Ck, Minhamite, W. Victoria.
Tannery Bore, Hindmarsh, South Australia.
?Lakes Entrance Oil Shaft, 50 ft, 100 ft.
?Cowandilla Govt Bore No. 5, 485-507 ft, Adelaide, South Australia.

Comments: The umbo is occasionally more pronounced than in the type particularly in specimens which have a strong anterior hump. North Arm specimens are smaller in size than the average specimens from Mississippi Ck. Comparing *Eucrassatella dorsennata* with *E. camura,* the former has an umbo which is more depressed and not flattened medially. *E. camura* does not possess the anterior hump and has a well marked siphonal ridge. Also 3b slopes posteriorly in *E. camura,* it is vertical or sloping anteriorly in *E. dorsennata*. Comparing *E. dorsennata* with *E. oblonga,* the former is more elongate and rectangular and does not have a high pointed umbo, *E. oblonga* does not have the anterior hump. The umbonal ribs are coarser in *E. dorsennata* and extend ventrally 0·5 cm more than in *E. oblonga.*

Some of the specimens from the Lakes Entrance Oil Shaft lack the typical anterior end of *E. dorsennata* and have a well marked siphonal ridge, the posterior end is also not as attenuated. Lack of sufficient material and precise depths prevents further interpretation.

Specimens from the Hindmarsh Bore compare well in shape with topotypes but have a larger number of finer ribs on the umbo.

Material: Type specimens, 32 topotypes. Ritchie's Cutting, 12 specimens.

North Arm, 9 specimens. Minhamite, 1 adult 6 juveniles. Tannery Bore, Hindmarsh, 17 specimens (mostly broken valves). Lakes Entrance Oil Shaft, 5 specimens.

Eucrassatella camura (Pritchard 1903)

(Pl. 13, fig. 12; Pl. 14, fig. 24; Pl. 15, fig. 33-34)

Crassatellites camurus Pritchard 1903, *Proc. Roy. Soc. Vict.* 15: 96, Pl. 64, fig. 5-9. Singleton 1945, ibid. 56: 256.

DESCRIPTION OF LECTOHOLOTYPE: MUGD 1762, right valve.

Valve small elongate subquadrate, umbo ¼ of the length of valve from anterior end. Anterior dorsal margin straight, posterior dorsal margin concave; anterior margin convex, ventral margin straight. Posterior margin straight abruptly truncating dorsal and ventral margins. Siphonal ridge well developed, somewhat curved towards posterior end.

Umbo prosogyral strongly incurved with a flattened area on the dorsal surface bounded by the siphonal ridge on the posterior side. This flattened area extends from the beak to about half way down the exterior of the valve.

Hinge plate short, wide and heavy about ¼ the height of the valve.

Teeth. LAI prominent, 3a small and pointed, 3b triangular, very wide at ventral end, very much projecting, sloping to the posterior end. 5b a very thin lamina. Pallial line entire. Internal ventral margin of valve smooth.

Umbo ornamented with about 21 concentric ribs fading out approx. 2·3 cm from the beak. Ribs are present on the posterior area fading out 9 mm from the beak. Surface of valve ornamented with growth striae only.

DESCRIPTION OF LECTOPARATYPE: MUGD 1761, left valve.

Valve quadrate slightly elongated. Umbo 2/7 of valve length from the anterior end. Anterior and posterior dorsal margins slightly concave. Anterior margin convex merging into the slightly convex ventral margin. Siphonal ridge well developed.

Teeth. Anterior lateral AII short but well developed. Socket for 3a large for the size of the tooth. 2, 4b short, the ventral end projecting in 2, more so than in 4. Resilifer partly covered by a small plate just under the beak.

Umbo ornamented with 26 concentric ribs which fade out 2·5 cm from the beak.

DIMENSIONS:

Lectoholotype	MUGD 1762	L56	A12	H40	T13	U38	$\frac{L}{U}$1·47	$\frac{L}{A}$4·7
Lectoparatype	MUGD 1761	53	15	41	14	40	1·32	3·5
	P23046	59	16	43	15	42	1·40	3·7

Forsyth's Bank

LOCATION OF TYPE: Melb. Uni. Geol. Dept, lectoholotype MUGD 1762. Lectoparatype MUGD 1761. Paratypes MUGD 1763, 1764, 1765, 1766. All juveniles figured by Pritchard. Collected by G .B. Pritchard.

TYPE LOCALITY: (*vide* Singleton 1945, p. 256) Grange Burn Formation.

Grange Burn between Forsyth's and Henty's, Hamilton, W. Vict. is herein designated type locality. Age Kalimnan. As Singleton has noted already the type specimens MUGD 1761, 1762 appear to have the preservation more typical of the Kalimnan of Grange Burn. The coloration of MUGD 1765, 1766, and 1763 suggests that these came from Muddy Ck, MUGD 1764 could possibly have come from either locality. *Eucrassatella camura* is more common on Grange Burn, the species is relatively uncommon at MacDonald's Bank on Muddy Ck.

STRATIGRAPHICAL DISTRIBUTION: Cheltenhamian (U. Mio.)—Kalimnan (L. Plio.).

OCCURRENCE: Forsyth's Grange Burn near Hamilton, W .Vict., common.
Between Forsyth's and Henty's, Grange Burn.
Pat's Gully, Grange Burn.
MacDonald's Bank, Muddy Ck, near Hamilton, W. Vict., rare.
Cheltenhamian Spring Ck, Minhamite, W. Vict., common.

MATERIAL: Type specimens. 21 specimens Grange Burn, 5 specimens (juvenile) MacDonald's Bank, 40 specimens Minhamite.

COMMENTS: This is the smallest fossil species of *Eucrassatella.* It is recognized by the elongate shell and prominent umbo which is flattened on the crest and side. Specimens from Minhamite do not appear to differ at all from typical Kalimnan specimens.

Eucrassatella kingicoloides (Pritchard 1903)

(Pl. 14, fig. 23, 25-26)

Crassatellites kingicoloides Pritchard 1903, *Proc. Roy. Soc. Vict.* 15: 94, Pl. 13, fig. 1-3. Singleton 1945, ibid. 56: 257.

DESCRIPTION OF HOLOTYPE: MUGD 1756, paired valves.

Shell equivalve, inequilateral, swollen below the umbo and somewhat flattened at the posterior end. Umbo prosogyral, prominent and slightly flattened, situated ⅖ the length of the shell from the anterior end. Anterior dorsal margin straight, posterior dorsal margin deeply concave, anterior margin strongly convex passing into a strongly convex ventral margin. Posterior dorsal and ventral margins attenuating, so that the posterior margin is much reduced.

Siphonal ridge prominent, strongly curved, flattening as it approaches the posterior end. Exterior of valve, just anterior to the siphonal ridge, somewhat flattened and even concave in the juvenile stages of the shell.

Hinge plate short, wide and thick about ⅓ umbo ventral diameter. Resilifer wide, ligament pit narrow.

Teeth. Right Valve. LAI small nearly obsolete, 3a narrow and thin, 3b large prominent sloping anteriorly, 5b minute, LPI large and elongated, slightly curved posteriorly. Left Valve. LAII small but prominent, finely striated on the dorsal side. 2 large sloping anteriorly, 4b long, the effective part of the tooth is the small projecting part at the ventral end, posterior laterals obsolete.

Umbo ornamented with 23 concentric ribs, these fade out 1·5 cm from the beak. Surface of valves ornamented with fine growth striae.

DIMENSIONS:

Holotype	MUGD 1756	L69	A26	H54	T18	U54	$\frac{L}{U}$1·28	$\frac{L}{A}$2·7
	P4139	68	26	55	18	55	1·24	2·6
	P23047	81	28	68	21	67	1·21	2·9
	P23048	64	20	56	17	55	1·16	3·2
	P23049	76	28	58	20	57	1·33	2·7

Location of Type: Melb. Uni. Geol. Dept, MUGD 1756, collected by G. B. Pritchard.

Type Locality: Jemmy's Point Formation. Jimmy's Point (=Jemmy's Point), Kalimna, Gippsland, Vict. Age Kalimnan.

Material: Type, 53 specimens, Jemmy's Point, Meringa Ck 6 specimens, Mississippi Ck 2 specimens.

Stratigraphical Distribution: Upper Cheltenhamian (U. Mioc.)-Kalimnan (L.Plio.).

Occurrence:	Upper and Lower Beds, Jemmy's Point.
	Nyerimalang F7 GSV Map Bairnsdale.
Kalimnan	Bunga Ck Rd Cutting N. Side, bed (d) (Wilkins 1963, p. 44).
	Lake Tyers Hartland Military Sheet 002312.
	Meringa Ck, GSV Map Bairnsdale 86679.
Upper	Base of Cliff, i.e. at S.L.
Cheltenhamian	Mississippi Ck Tramway Cutting F2 GSV Map Bairnsdale 878332.
	Bunga Ck Rd Cutting N. Side, bed (b).
	Old Bunga Ck Crossing F10 GSV Map Parish of Colquhoun.
	Turn off to LED No. 2 Princes Highway road cutting.

Comments: The shape of the species is rather variable. The umbos can be even more produced giving a greater posterior attenuation; however, the posterior end is usually not as attenuated as in the holotype, particularly in large adult specimens. Occasionally the umbones are orthogyral, e.g. P23050 from Mississippi Ck, and the shape of the shell approaches that of the genus *Hybolophus*. Woods (1922, p. 113) has compared *Hybolophus nelsoni* (Grzybowski) (= *clarensis* Woods) with *Eucrassatella kingicoloides;* however, *E. kingicoloides* generally lacks the prominent umbo-post-ventral depression characteristic of adult specimens of *Hybolophus* and the ventral margin is regularly convex, not having the posterior concavity in the ventral margin of specimens of *Hybolophus*. Occasionally, juvenile specimens of *E. kingicoloides* do tend to show a very slight concavity in the ventral margin and have a slight depression anterior to the siphonal ridge. The teeth of *E. kingicoloides* have more affinity with the type of *Eucrassatella* than with *Hybolophus antillarum* (Reeve) or *Hybolophus gibbosa* (Sowerby), the type of the genus.

Eucrassatella deltoides sp. nov.

(Pl. 13, fig. 15, 17; Pl. 15, fig. 30-31)

Etymology: Greek = delta-shaped.

Description of Holotype: P23051 right valve.

Valve trigonal, almost equilateral, umbo high and prominent, prosogyral, situated 5/12 of the valve length from the anterior end. Anterior and posterior dorsal margin straight sloping away equally from the top of the umbo. Convex anterior margin passing into a rather convex ventral margin. Posterior margin symmetrically truncating the posterior dorsal and ventral margins. Posterior end not attenuated.

Siphonal ridge well developed, and straight throughout its length.

Resilifer very wide and deep, external ligament pit deeply impressed.

Teeth. LAI obsolete, 3a obsolete, 3b prominent, pointed and sloping anteriorly, LPI long and prominent.

Distance between pallial line and anterior ventral margin of the valve is very wide, as in *E. kingicola*. Ventral margin of the valve smooth.

Umbo ornamented with 17 ribs which fade out 1cm from the beak. Surface of valve ornamented with growth striae.

Description of Paratype: P23052 left valve.

The valve is more inequilateral than the type as the posterior end is more produced.

Teeth. LAII prominent, 2 short, very pointed, 4b considerably reduced.

Umbo ornamented with 20 ribs which fade out 1·5 cm from the beak.

Dimensions:

Holotype	P23051	L74	A31	H66	T19	U66	$\frac{L}{U}$1·12	$\frac{L}{A}$ 2·4
Paratype	P23052	76	28	58	16	58	1·22	2·5
Paratype	F17002	75	30	66	18	66	1·14	2·5
	P23053	78	34	72	20	72	1·08	2·3
	P23054	68	29	64	19	64	1·06	2·3
	P23055	71	27	54	15	54	1·31	2·6

Location of Type: Nat. Mus. Vict., holotype P23051. collected by T. A. Darragh; paratype P23052. Tate Mus. Coll. Uni. Adel., paratype F17002.

Type Locality: Formation, lateral equivalent of the Dutchman Coquinoid Limestone.

Hill's dragline water hole with windmill, ½ mile N. of Dutchman Lime Quarry, NE. of Dutchman, Flinders Is., Tas. Age M(?) Plio.(Post Kalimnan).

Stratigraphic Range: M(?) Pliocene.

Occurrence: Type locality—common.

Dutchman Lime Quarry—common.

The dragline waterhole between the Memana Rd and Nelson Lagoon Drain, ¼ mile S. of the Cameron Inlet Rd, Flinders Is. (remanié deposit).

Material: Types and 48 topotypes; Quarry 11 specimens.

Comments: Specimens from the Dutchman Lime Quarry are a little more elongate than typical specimens from the type locality. The quarry has been filled in, making collection of a large series difficult. Comparing *E. deltoides* with *E. eupontica,* the former is relatively equilateral, has a more convex ventral margin and a very prominent umbo. The distance between the pallial line and the anterior ventral margin is ⅓ as large in *E. deltoides* as in *E. eupontica.*

Eucrassatella memanae sp. nov.

(Pl. 12, fig. 2-3; Pl. 13, fig. 19-20)

Etymology: Place name.

Description of Holotype: P23056 right valve.

Valve elongate subtrigonal; umbo prominent, slightly prosogyral situated ⅓ of the valve length from the anterior end. Anterior dorsal margin straight, posterior dorsal margin straight, posterior dorsal margin concave. Anterior margin and ventral margin of equal convexity. The early growth lines show a slight change in curvature just anterior to the siphonal ridge. Posterior margin slightly convex obliquely truncating the posterior dorsal and ventral margins. Posterior end somewhat attenuated.

Siphonal ridge present but not well developed, curved posteriorly and fading out as it nears the ventral margin.

Teeth. 3a obsolete, 3b prominent, 5b much reduced, LPI very long, rather thin. Resilifer very wide, external ligament pit hardly differentiated from the resilifer.

Ventral margin of the valve smooth.

Umbo ornamented with 25 ribs which fade out 1·8 cm from the beak. Surface of the valve ornamented with coarse growth striae.

Description of Paratype: P23057 left valve.

Less elongate than the holotype, the posterior dorsal margin is not as convex. The siphonal ridge is relatively straight, anterior to the ridge is a depression extending almost to the ventral margin, the early growth lines have a prominent change in curvature at this position.

Teeth. LAII prominent, 2 well developed short and pointed, 4b much reduced.

Umbo ornamented with 29 ribs fading out 2·3 cm from the beak.

Dimensions:

Holotype	P23056	L89	A29	H69	T19	U68	$\frac{L}{U}$1·31	$\frac{L}{A}$3·1
Paratype	P23057	85	32	64	19	64	1·33	2·7
Paratype	F17003	87	29	64	18	63	1·38	3·0
	P23058	111	38	84	23	81	1·37	2·9
	P23059	92	28	67	20	66	1·40	3·3

Location of Types: Nat. Mus Vict., holotype P23056; paratype P23057. Tate Mus., Uni. Adel., paratype F17003. Collected by T. A. Darragh.

Type Locality: The dragline drain 1 mile N. of No. 1 Rd. Locality 1·5 mile E. of the N.-S. Rd which is 1 mile W. of Memana. At fifth weir E. from the N.-S. Rd, 300 yds W. of small bridge over drain, Memana, Flinders Is., Tasmania. Age U.(?) Pliocene.

Stratigraphic Range: U.(?) Pliocene.

Occurrence: Type locality common.

Material: Type specimens, 18 topotypes.

Comments: Small specimens of this species show a change in curvature of the ventral margin near the posterior end, some of the specimens have a concave margin at this point. The majority of the larger specimens however, have lost the concave margin and the ventral margin is regularly convex. This character is better developed in this species than in *E. kingicoloides*. *E. kingicoloides* has a more prominently attenuated posterior end and is more tumid than *E. memanae*.

Some of the specimens collected had the remains of the resilum still attached to the resilifer.

Eucrassatella sp. indet.

Specimens have been examined of species of *Eucrassatella* from Fishing Point, Lake Bullenmerri, the Mallee Bores, and Loxton. The specimens were either fragmentary or too poorly preserved to allow specific identification. The Mallee

Bore specimens were identified by F. Chapman as *Eucrassatella kingicoloides*. However, this identification is not considered to be correct.

Genus **Spissatella** Finlay 1926

(Pl. 15, fig. 35-37)

Spissatella Finlay 1926, *Trans. N.Z. Inst.* 56: 256. Type species (original designation): *Crassatella traílli* Hutton 1873.

Shell equivalve, sub-quadrangular, sub-equilateral to elongate, posterior end obliquely truncating the dorsal and ventral margins. Umbo prosogyral and pointed. Lunule and escutcheon impressed.

Siphonal ridge very prominent. Ornament of concentric ribs generally extending from the umbo to the ventral margin of the shell, occasionally confined to the umbo. Hinge plate short with a triangular resilifer extending from under the beak to the ventral margin of the hinge plate. Ligament pit very narrow.

Tooth formula $\frac{3a \quad 3b \quad 5b \quad LPI}{LAII \quad 2 \quad 4b}$. 3a is relatively well developed, as is LAII, socket for LAII prominent, 5b thin and much reduced, no corresponding socket in the left valve.

Pedal impression deeply impressed beneath LAII and posterior to the anterior muscle scar. Pallial line entire, well marked. Muscle scars sub-equal similar to those of *Eucrassatella*. Inner ventral margin generally smooth occasionally crenulated.

Spissatella maudensis (Pritchard 1903)

(Pl. 12, fig. 1-8; Pl. 13, fig. 11; Pl. 14, fig. 22)

Crassatellites maudensis Pritchard 1903, *Proc. Roy. Soc. Vict.* 15: 93, Pl. 14, fig. 2, 3. Singleton 1945, ibid. 56: 257.

DESCRIPTION OF HOLOTYPE: MUGD 1759 right valve.

Valve elongate subquadrate. Umbo prosogyral, somewhat depressed, situated about ⅓ length of the valve from the anterior end, anterior and posterior dorsal margins straight and of equal declivity from the umbo, anterior margin strongly convex, ventral margin slightly convex, posterior margin abruptly truncating the ventral and dorsal margins.

Siphonal ridge well marked and straight, the siphonal area is slightly concave.

Hinge plate short, ⅓ height of the valve.

Teeth LAI short, not very prominent, 3a very small, 3b sloping anteriorly relatively thin but solid and prominent, 5b thin very little raised but rather long, LPI long prominent. Socket for 4b triangular, only slightly smaller than socket for 2.

Resilifer very wide and deep, extending from under the beak to the ventral edge of the hinge plate. It occupies all the space between 5b and LPI.

Ventral margin of the valve smooth.

Valve ornamented with prominent concentric ribs, these cover the entire surface of the juvenile portion of the valve, but fade out on the posterior area between the posterior dorsal edge and the siphonal ridge, and also fade out on the anterior end of the valve, being replaced by fine growth striae.

DESCRIPTION OF PARATYPE: MUGD 1748 right valve.

Somewhat more elongated than the type and has a straight ventral margin. The valve shows signs of abrasion and has a polyzoan attached.

Description of Hypotype: P4173 left valve.

Valve very elongate, posterior dorsal and ventral margins somewhat attenuated at the posterior end.

Teeth. LAII short, not prominent, 2 rather thin but prominent, 4b similar to 2 but slightly thinner, LPII prominent. Resilifer large, external ligament pit much reduced. Socket for LPI separated from the resilifer by a thin lamellar extension of LPII.

Dimensions:

Holotype	MUGD	1759	L55	A20	H37	T13	U36	$\frac{L}{U}$1·53	$\frac{L}{A}$2·8	
Paratype	MUGD	1758	47	16	30	10	30	1·57	2·9	
Hypotype	P4173		60	17	34	12	34	1·76	3·5	A^{d} 23
	P23060		60	20	37	12	37	1·62	3·0	'Spring Ck'
	P23061		68	23	41	13	40	1·70	3·0	A^{d} 22

Location of Type: Melb. Uni. Geol. Dept, MUGD 1759; paratype MUGD 1758; collected by G. B. Pritchard. Nat. Mus. Vict., hypotype P4173, collected by the Geological Survey.

Type Locality: 'Lower and Middle bed of the Spring Creek series, or Bird Rock Bluff, near Geelong'. The types have no other label than 'Spring Creek'. *Vide* Singleton 1943, p. 257. The preservation of the holotype is similar to specimens labelled Ad 22 in the collection of the National Museum, the paratype is similar to specimens from Ad 23.

Stratigraphical Distribution: Janjukian (U. Oligo.-L. Mioc.?).

Occurrence: Bird Rock Bluff, Torquay.

Ledge Bird Rock Cliffs, Cudmore Collection, Ad 22, Ad 23—very common.

Junction Band at section, Whale Cave, Half Moon Bay beyond Bird Rock, Colliver Collection. Apparently the species is restricted to the strata beneath the Bird Rock Cap.

Lower Maude—the only specimen is a juvenile which may be referable to this species.

No. 1 Bore, Parish of Bumberah, 711 ft—a poorly preserved specimen possibly referable to this species. F5318 CPC.

Material: Type specimens 22. Torquay, Ad 22 2 specimens, Ad 23 6 specimens. Lower Beds Maude 1 specimen, juvenile. No. 1 Bore, Parish of Bumberah 1 specimen.

Comments: Specimens are generally a little more elongated than the type specimen as in the hypotype P4173. The posterior edge of the holotype is broken, approximately 1 mm of the valve is missing. Pritchard (1903, p. 94) indicated the type specimen as having dimensions 'antero-posterior diameter, 56 mm; umbo-ventral diameter, 36 mm'. This specimen is Pl. 14, fig. 3 (Pritchard 1903).

A pair of valves P23062-3 in the Pritchard Collection at the National Museum has approximately the measurements given by him and appears to be the specimen referred to in his original description (Pritchard 1903, p. 94).

Stratigraphical Use

So far *Eucrassatella* has not proved of value in detailed stratigraphical correlation, probably for a number of reasons. Firstly, *Eucrassatella* is rare from

Longfordian to Bairnsdalian because of lack of exposures of suitable facies. Thus the exact range of species is in doubt. Secondly, correlation from basin to basin is difficult because many species seem to be restricted geographically. Species such as *Eucrassatella eupontica* sp. nov. that are widespread are also long ranging. Thirdly, it is often difficult to collect the complete valves necessary for reliable identification because they tend to break near the posterior muscle scar.

The most useful species on present knowledge is *Eucrassatella kingicoloides* which first makes its appearance near the top of the Cheltenhamian in Gippsland and becomes very common in the Kalimnan. It takes the place of *E. dorsennata* which is common in the Cheltenhamian but rare in the Lower Kalimnan.

Acknowledgements

The author wishes to thank the following persons for their help in various aspects of this work: Mr E. D. Gill, National Museum of Victoria, and Dr C. M. Tattam, Melbourne University Geology Department, for arranging loans; Dr C. A. Fleming, Geological Survey of New Zealand, and Dr J. M. Gaillard, Muséum National d'Histoire Naturelle Paris, for sending photographs; Miss Cecily Finlay and Dr G. A. Thomas, Melbourne University Geology Department, for help and advice in photography; Professor I. A. Korobkov, Leningrad, for sending literature; Miss J. Hope Macpherson, National Museum of Victoria, for discussion on living species; and Dr O. P. Singleton, Melbourne University Geology Department, for reading the manuscript.

Bibliography

Cotton, B. C., 1947. Some Tertiary fossil molluscs from the Adelaidean stage (Pliocene) of South Australia. *Rec. S. Aust. Mus.* 8 (4): 653-670, Pl. 20-22.

Crespin, I., 1950. Some Tertiary pelecypoda from the Lakes Entrance Oil Shaft, Gippsland, Victoria. *Proc. Roy. Soc. Vict.* 60: 149-156, Pl. 14-17.

Davies, A. M., 1935. *Tertiary Faunas* I. Thomas Murby & Co., London.

Dennant, J., and Kitson, A. E., 1903. Catalogue of described species of fossils (except Bryozoa and Foraminifera) in the Cainozoic fauna of Victoria, South Australia and Tasmania. *Rec. Geol. Surv. Vict.* 1 (2): 89-147.

Finlay, H. J., 1926. New shells from New Zealand Tertiary beds, Pt 2. *Trans N.Z. Inst.* 56: 227-258, Pl. 55-60.

Finlay, H. J., and Marwick, J., 1937. The Wangoloan and associated molluscan faunas of Kaitangata—Green Island Subdivision. *N.Z. Geol. Surv. Pal. Bull.* 15.

————, ————, 1940. The Divisions of the Upper Cretaceous and Tertiary in New Zealand. *Trans. Roy. Soc. N.Z.* 70 (1): 77-135.

Iredale, T., 1924. Results from Roy Bell's molluscan collections. *Proc. Linn. Soc. N.S.W.* 49 (3): 179-278, Pl. 33-36.

Johnson, R. M., 1888. *Systematic Account of the Geology of Tasmania.* Government Printer, Hobart.

Korobrov, I. A., 1954. *Handbook on and Systematic Guide to the Tertiary Mollusca. Lamellibranchia.* State Scient-Tech. Publishing Agency Oil & Mineral Fuel Lit., Leningrad. (In Russian).

Lamarck, J. B. de, 1805. Suite des mémoires sur les fossiles des environs de Paris. *Ann. Mus. Hist. Nat. Paris* VI: 407-415.

————, 1818. Histoire naturelle des animaux sans vertèbres. 5, Paris.

Lamy, E., 1913. Note sur quelques coquilles du genre *Crassatella* déterminées par Lamarck. *Bull. Mus. Nat. Hist. Nat., Paris* 19 (2): 99-105.

————, 1917. Revision des Crassatellidae vivants du Muséum d'Histoire Naturelle de Paris. *Jour. de Conchyl.* 62 (4): 197-270, Pl. 6.

Ludbrook, N. H., 1955. The molluscan fauna of the Pliocene strata underlying the Adelaide Plains, Pt II—Pelecypoda. *Trans. Roy. Soc. S. Aust.* 78: 18-87, Pl. 1-6.

Macpherson, J. H., and Gabriel, C. J., 1962. *Marine Molluscs of Victoria.* Melbourne University Press.

MAY, W. L., 1919. A revised census of the Mollusca and Brachiopoda in the Table Cape Beds. *Proc. Roy. Soc. Tas.* for 1918: 101-107.

MIZUNO, A., 1952. Descriptions of the Paleogene molluscs from Sakito, Nagasaki Prefecture, Japan. *Trans. Proc. Palaeont. Soc. Japan* 6: 185-193, Pl. 17.

NAGAO, T., Palaeogene fossils of the Island of Kyushu, Japan, Pt 2. *Sci. Rep. Tohoku Imp. Univ. Ser. 2 (Geol.)* 12 (1): 11-140, Pl. 1-17.

PRITCHARD, G. B., 1896. A revision of the fossil fauna of the Table Cape Beds, Tasmania, with descriptions of new species. *Proc. Roy. Soc. Vict.* 8: 74-150, Pl. 2-4.

————, 1903. Contributions to the palaeontology of the Older Tertiary of Victoria. Lamellibranchs. Pt 3. ibid. 15: 87-103, Pl. 12-15.

SHUTO, T., 1957. *Crassatellites* and *Venericardia* from the Miyazaki Group (Palaeontological study of the Miyazaki Group—IV). *Mem. Fac. Sci. Kyushu Univ. Ser. D Geology* VI (2): 69-89, Pl. 1.

SINGLETON, F. A., 1945. A catalogue of type and figures specimens of fossils in the Melbourne University Geology Department. *Proc. Roy. Soc. Vict.* 56: 229-284.

STEWART, R. B., 1930 Gabb's California Cretaceous and Tertiary type Lamellibranchs. *Acad. Nat. Sci. Philadelphia* Special Pub. 3.

TENISON WOODS, J. E., 1876. On some Tertiary fossils from Table Cape. *Proc. Roy. Soc. Tas.* for 1875: 13-26, 3 Pl.

VERCO, J. C., 1905. Notes on South Australian marine mollusca, with descriptions of new species, Pt II. *Trans. Roy. Soc. S. Aust.* 29: 166-172, Pl. 31.

————, 1907. Notes on South Australian marine mollusca with descriptions of new species, Pt VII. ibid. 31: 305-315, Pl. 29.

WILKINS, R. W. T., 1963. Relationships between the Mitchellian, Cheltenhamian and Kalimnan Stages in the Australian Tertiary. *Proc. Roy. Soc. Vict.* 76: 39-59.

WOODS, H., in Bosworth, T. O., 1922. *Geology of Northwest Peru*, Macmillan, London.

Explanation of Plates

All photographs for illustration, except fig. 35-40, were taken by the author. Fig. 35-37 were supplied by Dr C. A. Fleming, Geological Survey of New Zealand, and fig. 38-40 by Dr J. M. Gaillard, Muséum National d'Histoire Naturelle Paris.

PLATE 12

Fig. 1—*Spissatella maudensis* (Pritchard), MUGD. 1759, holotype internal right valve, Torquay, Vict., × 1.

Fig. 2—*Eucrassatella memanae* sp. nov., P23057, paratype internal left valve, Memana, Flinders Is., Tas., × 0·75.

Fig. 3—ditto, paratype external left valve, × 0·72.

Fig. 4—*Eucrassatella oblonga* (Tenison Woods), B27 Z199, type of *Crassatella aphrodina* Tenison Woods, upper bed Fossil Bluff near Wynyard, Tas., × 1.

Fig. 5—*Eucrassatella rosicollina* sp. nov., P23078, holotype external right valve, Moondara Farm, Mitchell R., Gippsland, Vict., × 0·73.

Fig. 6—*Eucrassatella rosicollina* sp. nov., P23079, paratype internal left valve, topotype, × 0·75.

Fig. 7—*Eucrassatella rosicollina* sp. nov., P23078, holotype internal right valve, locality as above, × 0·76.

Fig. 8—*Spissatella maudensis* (Pritchard), MUGD 1759, holotype external right valve, Torquay, Vict., × 1.

Fig. 9—*Eucrassatella oblonga* (Tenison Woods), B42 Z174, holotype external left valve, lower bed Fossil Bluff near Wynyard, Tas., × 0·75.

Fig. 10—ditto, holotype internal left valve, × 0·71.

PLATE 13

Fig. 11—*Spissatella maudensis* (Pritchard), P4173, hypotype internal left valve, Ad 23, Torquay, Vict., × 0·95.

Fig. 12—*Eucrassatella camura* (Pritchard), MUGD 1761, lectoparatype internal left valve, Grange Burn near Forsyth's Bank, Hamilton, Vict., × 1.

Fig. 13—*Eucrassatella eupontica* sp. nov., P23074, holotype internal right valve, shell-bed above nodule bed Beaumaris, Vict., × 0·77.

Fig. 14—ditto, holotype external right valve, × 0·73.

Fig. 15—*Eucrassatella deltoides* sp. nov., P23052, paratype external left valve, E. side of Dutchman, Flinders Is., Tas., × 0·70.

Fig. 16—*Eucrassatella eupontica* sp. nov., P23075, paratype internal left valve, note remains of resilium, Warrambine Ck near Shelford, Vict., × 0·97.
Fig. 17—*Eucrassatella deltoides* sp. nov., P23051, holotype external right valve, E. side of Dutchman, Flinders Is., Tas., x 0·70.
Fig. 18—*Eucrassatella dorsennata* sp. nov., P23043, paratype internal left valve, Mississippi Ck tramway cutting near Lakes Entrance, Gippsland, Vict., × 0·92.
Fig. 19—*Eucrassatella memanae* sp. nov., P23056, holotype internal right valve, Memana, Flinders Is., Tas., × 0·74.
Fig. 20—ditto, holotype external right valve, × 0·72.

Plate 14

Fig. 21—*Eucrassatella oblonga* (Tenison Woods), P23073, hypotype internal right valve, lower bed Fossil Bluff near Wynyard, Tas., × 0·77.
Fig. 22—*Spissatella maudensis* (Pritchard), P4173, hypotype external left valve, Ad 23, Torquay, Vict., × 1.
Fig. 23—*Eucrassatella kingicoloides* (Pritchard), MUGD 1756, holotype external right valve, Jemmy's Point near Lakes Entrance, Gippsland, Vict., × 0·77.
Fig. 24—*Eucrassatella camura* (Pritchard), MUGD 1761, lectoparatype external left valve, Grange Burn near Forsyth's Bank, Hamilton, Vict., × 1.
Fig. 25—*Eucrassatella kingicoloides* (Pritchard), MUGD 1756, holotype internal right valve, Jemmy's Point near Lakes Entrance, Gippsland, Vict., × 0·79.
Fig. 26—ditto, holotype internal left valve, × 0·73.
Fig. 27—*Eucrassatella dorsennata* sp. nov., P23043, paratype external right valve, topotype, × 0·92.
Fig. 28—*Eucrassatella dorsennata* sp. nov., P23042, holotype internal right valve, Mississippi Ck near Lakes Entrance, Gippsland, Vict., × 1.
Fig. 29—ditto, holotype external right valve, × 0·92.

Plate 15

Fig. 30—*Eucrassatella deltoides* sp. nov., P23051, holotype internal right valve, E. side of Dutchman, Flinders Is., Tas., × 0·75.
Fig. 31—ditto, paratype internal left valve, × 0·73.
Fig. 32—*Eucrassatella eupontica* sp. nov., P23075, paratype external left valve, Warrambine Ck near Shelford, Vict., × 0·94.
Fig. 33—*Eucrassatella camura* (Pritchard), MUGD 1762, lectoholotype internal right valve, Grange Burn near Forsyth's Bank, Hamilton, Vict., × 1.
Fig. 34—ditto, lectoholotype external right valve, × 1.
Fig. 35—*Spissatella trailli* (Hutton), hypotype internal left valve, Awamoa, New Zealand, × 1.
Fig. 36—*Spissatella trailli* (Hutton), holotype internal right valve, Awamoa, New Zealand, × 1.
Fig. 37—ditto, holotype external right valve, × 1.
Fig. 38—*Eucrassatella kingicola* (Lamarck), holotype external left valve, note locality written on valve, King Is., Tas., × 0·75.
Fig. 39—ditto, holotype internal right valve, × 0·75.
Fig. 40—ditto, holotype internal left valve, × 0·75.